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Optimising Maintenance Cost Performance with Skilled Technicians

Abstract

Purpose: High maintenance cost is the common issue in building industry due to low service quality of maintenance management in Malaysia. Lack of preventive measure is the problem that implicates poor maintenance performance. Scheduled maintenance is suggested to improve the maintenance performance. However, the effectiveness of scheduled maintenance can be greatly influenced by the availability of skilled technicians. Thus, this paper aims to identify the aspects of skilled technician to be concerned in maintenance management, as well as to establish the relationship between the aspects and maintenance cost performance.

Design/Methodology/Approach: A quantitative approach is adopted and carried out through questionnaire survey. Furthermore, descriptive analysis and correlation analysis are used to analyse the research data.

Findings: The literature review identifies three aspects of skilled technician to be concerned in maintenance management. Then, research result demonstrates that the skill and knowledge of technician is significantly correlated to the maintenance cost variance. The skill and knowledge of technician must be considered in maintenance planning and execution.

Originality/Value: The research recommends the maintenance management to employ skilled technician through thorough hiring process and to encourage the existing maintenance staff for participating the relevant training, workshop or seminar.

Keywords: Skilled technician; skill and knowledge; scheduled maintenance; cost performance

1. Introduction

High maintenance cost becomes a common issue in construction industry nowadays (El-Haram & Horner, 2002). The main cause of this issue is low service quality of maintenance management in Malaysia (Kamaruzzaman & Zawawi, 2010; Ruslan, 2007). In fact, lack of preventive measure is currently the problem that implicates poor maintenance performance. Thus, introduction and implementation of preventive

maintenance is highly recommended to solve the issue high maintenance cost (Au-Yong et al., 2013b).

Scheduled maintenance, as one of the strategies of preventive maintenance, is favourably to be implemented in building maintenance (Forster & Kayan, 2009). It is defined as the preventive maintenance that is carried out in accordance with criteria such as the predetermined intervals of time, number of operations, mileage, etc., so as to ensure that such components remain in good condition (Flores-Colen & De Brito, 2010; Horner et al., 1997; Nilsson, 2007; Seeley, 1987).

However, the effectiveness of scheduled maintenance can be greatly influenced by the availability of skilled technicians. Whereby, lack of maintenance staff, poor workmanship and lack of expertise are demonstrated as the factors that contributing to poor maintenance outcome (Au-Yong et al., 2013a). In Malaysia, the standard of maintenance technicians is yet below expectation to improve the effective of the maintenance strategy. It is mainly due to several negative characteristics, including (Zawawi & Kamaruzzaman, 2009):

- Lack of working experience
- Limited skill and knowledge in terms of technical and administrative aspects
- Overworked staff
- Poor organisation structure

Taking into cognizance the influence of skilled technician towards maintenance performance, this paper aims to identify the aspects of skilled technician to be concerned in maintenance management, as well as to establish the relationship between the aspects and maintenance cost performance.

2. Skilled Technician

Skilled technicians are the maintenance personnel who able to perform the inspection, maintenance, repairs, and replacement works accordingly. Their commitment in maintenance management is important, especially in the execution of maintenance tasks. In order to optimise the maintenance performance, several aspects of skilled

technician need to be concerned in maintenance management. The aspects are shown in Figure 1.

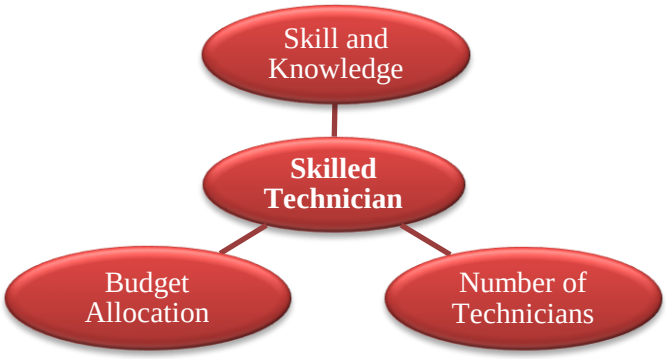

Figure 1: Aspects of skilled technician

2.1 Budget Allocation for Skilled Technician

Since scheduled maintenance is carried out in a fixed time interval, it requires permanent maintenance personnel or technicians to perform the tasks. Lai et al. (2008) pointed out that one of the cost items that need to be considered in maintenance budgeting is labour cost. Meanwhile, Pandey et al. (2010) formulated the expected cost of preventive maintenance by considering labour cost in their research.

Maintenance management is a process that allocates and coordinates the resources, including the labour to enhance the maintenance performance such as reliability, safety, function, comfort, and convenience (Idrus et al., 2009). Thus, budget allocation for skilled technician must be considered in the management to optimise maintenance performance. Commonly, the organisation allocates different amount of salary for the maintenance personnel based on their category of competency.

2.2 Skill and Knowledge of Technician

Typically, some of the scheduled maintenance works are determined by experienced and skilled technicians, who observe the wear and tear of the parts or components. Thus, the technicians should not only limit their capability to replacing and overhauling system components, but they must be capable to identify the need of scheduled maintenance. For example, technicians may decide to make adjustment on

maintenance interval when they perform system inspection at each time of the maintenance interval (Mann et al., 1995).

Indeed, one of the main barriers to effective maintenance management is lack of skill and knowledge (Kangwa & Olubodun, 2003). They further explained that inability to determine quality of work done by the maintenance personnel themselves may lead to the occurrence of bad impact, such as incompetency in detecting unwanted error and mistake made by them. Thus, the competency of the maintenance labour force is an important factor that affecting the maintenance outcome (Groote, 1995).

2.3 Number of Technicians

Scheduled maintenance requires appropriate and adequate maintenance technicians to carry out the repair and replacement tasks in fixed time interval (Au-Yong et al., 2013a). Subsequently, the maintenance tasks are able to restore the conditions of building and systems to the acceptable standard, and hence, reduce the probability of building or system failure (Hameed et al., 2010).

In fact, maintenance labour is highly demanded for scheduled maintenance activities (Horner et al., 1997). Unlike condition-based maintenance that can bring down the cost of labour, scheduled maintenance requires large amount of budget allocation in terms of labour aspect (Carnero, 2006). Thus, employing minimum but optimum labour with acceptable qualification standard is the best way to minimise maintenance cost (Ali et al., 2010). The number of skilled technicians must be sufficient to maintain the reliability and quality of building and systems.

3. Maintenance Performance

Development of performance measurement in management is to improve quality and service, as well as meeting cost parameters (Amaratunga & Baldry, 2002). Measurement of maintenance performance is an assessment that helps to identify the strengths and weaknesses of the maintenance activities. In addition, the result of performance measurement indicates the effectiveness of existing strategy. Consequently, the management team is able to plan and make appropriate decision for future maintenance strategy.

Financial measure is one of the performance indicators widely used. Typically, variance analysis is performed to assess the financial measures (Tsang et al., 1999). Although there are some arguments about the reliability of variance analysis, it is found that the method is adoptable and reliable. Whereby, Rahmat & Ali (2010) demonstrated that the effectiveness of refurbishment projects could be determined by cost variance analysis. They computed the ratio of actual refurbishment cost to target refurbishment cost as the cost variance in their research.

In addition, Swanson (2001) proved that the maintenance performance is dependent to the implementation of maintenance strategies by analysing the reduction in production cost, which is cost variance. He compared the current production cost to the previous production cost. At the end of the study, he found that the proactive and aggressive maintenance strategies positively influenced the reduction in production cost; while reactive maintenance negatively affected the reduction in production cost.

Thus, the aspect of cost or expenditure for building maintenance is mostly used in measuring the performance of buildings. Commonly, maintenance performance is calculated using variance of actual expenditure and planned cost for building maintenance activities (Ali, 2009). Comparison between actual and planned cost is made to identify the level of maintenance performance. For instance, maintenance performance of a building system is deemed below expectation when the actual spending for maintenance tasks is more than the planned cost. In contrast, high performance level is achieved when the total expenditure is less than the planned cost for the maintenance works. Since the rising maintenance cost is one of the major issues concerned by the industry and public, the cost performance is concerned in this research.

4. Research Methodology

This research adopted quantitative approach with reference to the research undertaken by (Ali, 2009). In order to get a high response rate, the questionnaire should be short and simple. It would not take much time for the respondents to answer too. So, close-ended questions were drafted in 5-point Likert scale and multiple choices. Simple random sampling was adopted to identify relevant respondents who have been or are

currently involved in building maintenance management in Klang Valley, Malaysia. Furthermore, the respondents were required to answer questions based on their experience or involvement in maintenance management for high-rise office buildings. The buildings must have a minimum of seven storeys, which is defined as high-rise building under Uniform Building By-Laws 1984, because the high-rise buildings are usually equipped with more complex systems like HVAC system, lift system, and fire fighting system. This would greatly require the skilled technicians to perform the maintenance tasks. Meanwhile, the research studied on those buildings that weremore than two years old because the maintenance requirements of new buildings are different from the older buildings. Commonly, the maintenance tasks to be implemented for a new building are less compared to old building (Nik Mat, 2009). Questionnaire survey requires a minimum response rate of 30 percent to produce reliable and convincing results (Hoxley, 2008). In this research, a total of 300 questionnaires were distributed to the building manager, building executive and supervisor, technician and other maintenance personnel within Klang Valley. Out of 113 responses, 101 were found to be useful and valid for the analysis. The remaining 12 questionnaires were incomplete orinvalid for some reasons. Therefore, a response rate of 38 percent was achieved. The demographic profile of respondents is shown in Table 1. 83 percent of the respondents were building managers, executives, and supervisors. They have considerable expertise in the planning and implementation of the maintenance strategy. Commonly, they understand the importance of the criteria of building technicians through organising, coordinating, supervising, and monitoring the technicians in maintenance execution. In addition, 85 percent of the respondents havemore than five years working experience in maintenance management (see Table 2). Thus, the collected data were deemed reliable.

Table 1: Demographic profile of the respondents

Position	**Percentage (N = 101)**
Building manager	50
Building executive/ supervisor	33
Building technician	10
Others	7

Table 2: Working experience of the respondents

Working Experience	Percentage (N=101)
<6 years	15
6-10 years	49
11-15 years	19
>15 years	17

5. Findings and Discussion

Ranking analysis determines the importance of the variables in the research. The mean score (with 1 – not important at all to 5 – very important) indicates the level of importance among the aspects of skilled technician in maintenance management as shown in Table 3.

Table 3: Importance level of the aspects of skill technician

Rank	Variable	Mean (N=101)	Std. Deviation
1	Skill and knowledge	3.41	0.982
2	Budget allocation	3.32	0.871
3	Number of technicians	2.83	0.873

It is found that the skill and knowledge of maintenance technician is at the highest rank, with 3.41 mean score. Meanwhile, the standard deviation value of 0.982 indicates the widespread of data and eliminates the issue of biased data. A skilful and experienced technician is able to eliminate error and mistake when carry out the maintenance works. Furthermore, the skilled technicianis able to detect abnormal condition of a system when executing the maintenance tasks. The result supports the importance of labour qualification in building maintenance (Groote, 1995).

In order to employ skilful and knowledgeable building technician, budget allocation for technician recruitment becomes an important aspect. Generally, the amount salary of a technician is positively proportional to his level of skill and knowledge. Thus, the result states that the budget allocation for skilled technician is ranked second with the mean score of 3.32, and standard deviation value of 0.871. The finding validates that large amount of budget allocation is required for skilled labour (Carnero, 2006). Apart from the skill and knowledge of technician, the morale of technician in the management is significant. By having better pay, the technician would be likely to work more effectively.

However, the number of technicians is at the lowest rank with mean score of 2.83, which is below 3.00. The data are normally distributed with a standard deviation value of 0.873. The finding reflects that excessive number of technicians is not significant in effective maintenance management. Oppositely, unnecessary budget is required to pay the salary of extra technicians. Therefore, the result verifies that employing optimal number of technicians with acceptable qualification standard is more cost effective (Ali et al., 2010).

Then, an associative test using Spearman rank correlation coefficient analysis establishes the relationship between the aspects of skilled technician and maintenance cost performance as shown in Table 4. In fact, higher concern towards the aspects is likely to reduce the cost variance. Therefore, negative correlation between the aspects and cost varianceis expected in the analysis outcome.

Table 4: Correlation matrix between the aspects of skilled technician and maintenance cost variance

Variable	**Cost Variance**
Skill and knowledge	-0.417*
Budget allocation	-0.153
Number of technicians	-0.182

*. Correlation is significant at the 0.05 level

In the associative test, null hypothesis is rejected at significance level of 0.05. In other words, the probability of error in rejecting the null hypothesis is 5 percent. The null (H_0) and alternative (H_1) hypothesis are stated as follow:

- H_0 – There is no significant correlation between the aspects of skilled technician and maintenance cost performance.
- H_1 – There is significant correlation between the aspects of skilled technician and maintenance cost performance.

The correlation analysis result indicates that there is significant correlation between the skill and knowledge of technician and cost variance. The technicians without proper skill and knowledge are more likely to misjudge and misinterpret the condition or problem of a building system. The repair and replacement works done by such technician might not be appropriate. As a result, further damages will occur and

additional repair works will be required. As such, the task spends additional maintenance cost and this leads to the issue of over-budget. Meanwhile, the system breakdown rate increases.

Therefore, the result rejects the null hypothesis and accepts the alternative hypothesis. Although the objective of this study is achieved, it is believed that there are more factors influencing the maintenance cost performance such as the service provider or contractor, further explorative study is required to determine the significant factors that influencing the cost performance.

6. Conclusion

The literature review identified three important aspects of skilled technician in maintenance management. The result of associative test demonstrates significant correlation between the skill and knowledge of technician and cost variance. Lack of skill and knowledge implicates costly impact in maintenance management. Therefore, the importance of technicians' skill and knowledge must be taken into consideration in the maintenance organisation. Improved technicians' skill and knowledge are likely to optimise the maintenance outcome and expenditure. The research recommends the maintenance management to employ skilled technician through thorough hiring process, including higher qualification requirement. For example, theapplicants must possessdiploma or professional certificate in building management or electric and electronicengineering; or experience as a registered electrician with relevant certificate. Additionally, the management should encourage the existing maintenance staffs to participate the relevant training, workshop or seminar. For instance, the organisation can provide financial support to the staffs for participating training or workshop related to building maintenance once a year.

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Appendix: Questionnaire Sample

SECTION A – Respondent's Particular

1. What is your job title?
   [ ] Building Manager [ ] Building Executive/ Supervisor
   [ ] Building Technician [ ] Others, please specify _____

2. How long have you involved in the building maintenance industry?
   [ ] Less than 6 years [ ] 6 - 10 years [ ] 11 - 15 years [ ] More than 15 years

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SECTION B – Maintenance Characteristics

1. Please rate the degree of concern towards the following variable in maintenance of high-rise office building by using the scales below:
   1=Very low degree; 2=Low degree; 3=Average; 4=High degree; 5=Very high degree

	Very low degree 1	2	3	4	5 Very high degree
Skilled Technician					
(a) Budget allocation					
(b) Skill and knowledge					
(c) Number of technician					

SECTION C – Maintenance Performance

1. Please specify the ratio of actual maintenance expenditure to planned maintenance expenditure of the maintenance tasks. (E.g. if the actual maintenance expenditure was RM15,000 and planned maintenance expenditure was RM10,000, divide 15,000 by 10,000, so the ratio is 1.5)
   [ ] 0 – 0.80 [ ] 0.81 – 0.90 [ ] 0.91 – 1.00
   [ ] 1.01 – 1.10 [ ] 1.11 – 1.20 [ ] more than 1.20